

# Low-Stress Silicon Cladding for Surface Finishing Large UVOIR Mirrors, Phase I

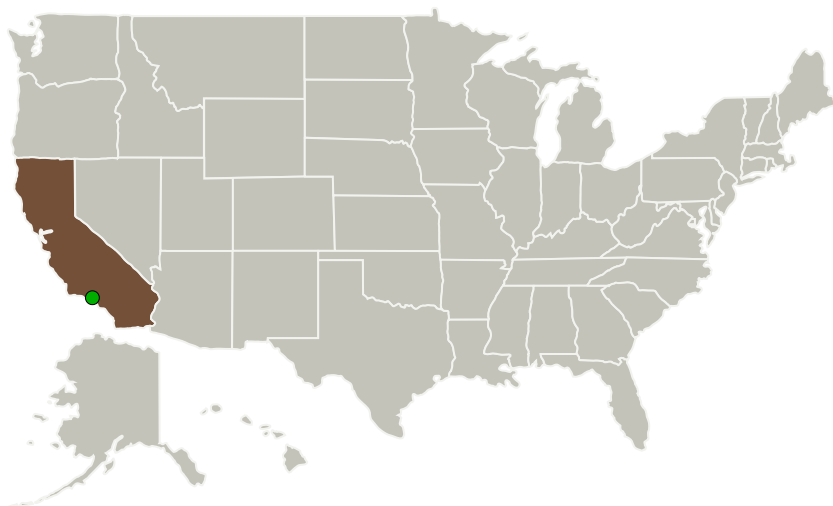
Completed Technology Project (2013 - 2013)



## Project Introduction

In this Phase I research, ZeCoat Corporation will develop an affordable, low-stress silicon cladding process which is super-polishable for large UVOIR mirrors. The proposed ion-assisted evaporation process is directly scaleable to SiC mirrors several meters in diameter. The process is based on a novel, low temperature, ion-assisted, evaporation technique (IAD), whereby the coating stress of a silicon film may be manipulated from compressive to tensile, in order to produce a near-zero net stress for the complete layer. A cladding with little intrinsic stress is essential to minimize bending that would otherwise distort the figure of very lightweight mirrors. Current methods to produce a polishable silicon cladding utilize CVD processes that produce highly stressed Si coatings. The current processes require high-temperatures (hundreds of degrees Celsius) and are not readily scaleable to large mirrors. CVD Si cladding is currently limited to mirror substrates less than 1-meter in diameter. The proposed IAD process produces little heat, and the mirror size is limited only by the size of the vacuum chamber. Large silicon carbide (SiC) mirrors (3-4 meters in diameter) are being considered for future space-based UVOIR astronomy missions. These lightweight mirrors will likely require a highly-polishable layer of silicon (10 to 50 microns) applied on top of the SiC. A relatively thick layer of Si is desirable for the purpose of reducing figuring time and for achieving a super-polished surface, suitable for UV astronomy. Normal incidence 4-meter class UVOIR telescopes have been cited as a high priority by multiple government review panels including; the National Research Council's (NRC) study of NASA's Space Technology Roadmap and Priorities, The Office of the Chief Technologist, The Cosmic Origins Program and NWNH Decadal.

## Primary U.S. Work Locations and Key Partners



Low-Stress Silicon Cladding for Surface Finishing Large UVOIR Mirrors

## Table of Contents

|  |   |
|--|---|
| Project Introduction                         | 1 |
| Primary U.S. Work Locations and Key Partners | 1 |
| Project Transitions                          | 2 |
| Images                                       | 2 |
| Organizational Responsibility                | 2 |
| Project Management                           | 2 |
| Technology Maturity (TRL)                    | 2 |
| Technology Areas                             | 3 |
| Target Destinations                          | 3 |

# Low-Stress Silicon Cladding for Surface Finishing Large UVOIR Mirrors, Phase I

Completed Technology Project (2013 - 2013)



| Organizations Performing Work    | Role                    | Type        | Location             |
|----------------------------------|-------------------------|-------------|----------------------|
| ZeCoat Corporation               | Lead Organization       | Industry    | Torrance, California |
| ● Jet Propulsion Laboratory(JPL) | Supporting Organization | NASA Center | Pasadena, California |

## Primary U.S. Work Locations

California

## Project Transitions

**May 2013:** Project Start**November 2013:** Closed out

### Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/140447>)

## Images



### Project Image

Low-Stress Silicon Cladding for Surface Finishing Large UVOIR Mirrors

(<https://techport.nasa.gov/image/132815>)

## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Organization:

ZeCoat Corporation

### Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

### Program Director:

Jason L Kessler

### Program Manager:

Carlos Torrez

### Principal Investigator:

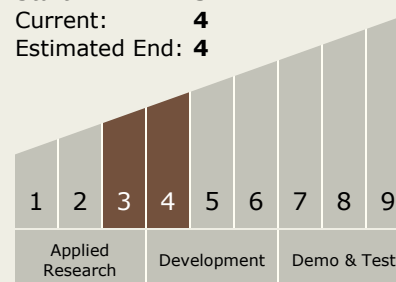
David Sheikh

## Technology Maturity (TRL)

Start: **3**

Current: **4**

Estimated End: **4**



# Low-Stress Silicon Cladding for Surface Finishing Large UVOIR Mirrors, Phase I

Completed Technology Project (2013 - 2013)



## Technology Areas

### Primary:

- TX08 Sensors and Instruments
  - └ TX08.2 Observatories
    - └ TX08.2.1 Mirror Systems

## Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System